"THE STRUCTURE OF INFORMATICS : A FRAMEWORK FOR SYSTEM DEVELOPMENTS

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Pengantar Redaksi,

Pada tanggal 7 - 8 November 1983 yang baru lalu, Ir. F. Soesianto BSc.E mengikuti Symposium on the Pedagogic of Computer Education di University Sains, Penang-Malaysia. Symposium ini adalah salah satu program dari Association of South-East Asian Institution of Higher Education yang mana Universitas Gadjah Mada menjadi salah satu anggotanya. Berikut ini adalah paper yang disampaikan Ir. F. Soesianto BSc.E dalam Symposium tersebut.

ABSTRACT :

In this paper a four layer structure of the informatics is presented as a unifying principle for all computer based systems. The place and the role of the computer science is also identified. The structure provides a very convenient framework for system developments, in developing countries.

Introduction

When the announcement was made of the establishment of the Systems and Informatics Laboratory in the Department of Electrical Angineering, Gadjah Mada University, many questions are received. One inquired about what is meant by "systems", and a gentle explanation that the lab would do research on electrical systems may satisfy the curiosity of some and discourage further probing by others. Similarly, one can also say that informatics talks about computers, how they are designed, put into operation, and how they are used for a specific purpose. But to those who have some responsibility to discharge, either academically or professionally, these explanations are certainly unsatisfactory and insufficient.

Behind this tyrany of words (according to Paul Samuelson) there seems to be something more fundamental to be dealt with, namely the philosophy and the programs. Specifically, what is needed is a framework upon which programs are formulated, activities are performed, and research is conducted. The same same applies to all computer-related activities and, in my opinion, to all systems development. For the workers in the field, an identity is needed to distinguish their activities from those in other fields of enquiry.

In this paper I would like to suggest a framework which constitutes the body of knowledge which we usually call the informatics, and which, in my opinion, can be used as the basis for developing computer-based systems. The proposed structure can also become the framework upon which a curriculum in computer science can be organized.

Systems, Data and Information

"System" is the concept that refers both to a complex of interdependencies between parts, components, and processes that involves discernible regularities of relationship. A system is a collection of objects which become the focus of our attention, because some purpose is attached to this collection of objects, either by the observer (i.e. to gain knowledge), or merely by its own existence (i.e. it serves a purpose). One can distinguish two kinds of system, namely the physical systems, and the living systems. A physical system obeys laws that can stand as an accurate description of its nature and processes. These laws are practically established and can be explicitly stated in terms of mathematical relations. It is internally consistent, reproducible and of general validity

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for all time and space. A specific physical system is studied, because specific information is sought, advancement of knowledge is to be gained, and an engineered physical system is to be developed for human use.

In the living system, the laws that govern its nature and mechanism are only partially established and cannot be accepted as universal truth, because living systems are colored by time, habit, culture and heritage. We study living systems, because we want to understand the world we live in and of ourselves as part of that world. In fact this is what science is, namely to discover, to verify and to organize knowledge.

Knowledge, like beauty and liberty, is good for its own sake. But in all science, knowledge is sought primarily for its instrumental value, to help improve the quality of our life. Inevitably we want knowledge to help us in formulating some mix of objectives based on varying trade-offs. The persuit of these objectives in organized activity requires policies (or decisions) which can appropriately be developed if we have a body of information about the system to support it.

It becomes the first task of a researcher to collect data about the system he is working on, and to present it in the form suitable for further processing. But what data are to be collected is not a simple issue. Granted, that the task of a reserach is to develop or to formulate decisions, then a hypothesis should be forwarded that are both valid and useful for the formulation of the decisions. The hypothesis should have realism and relevance, or at least should be refutable. The kinds of data which are to be collected should conform to these requirements. An instrument is to be designed and proper care should be taken to guarantee that it measures only what is expected to be measured.

Once the data are obtained, the next step would be the processing itself. Statistics is the body of knowledge suitable for this purpose *if* we can consider the system as a sample of the population in which it is only a member, and we want to make valid conclusions (i.e information) about the population, based on the data provided by the statistical model of the sample. Another kind of processing presupposes intimate knowledge about the relationship among the various elements of the data. As stated before, the knowledge is of general validity formulated as mathematical expressions and the task is essentially to extract the information from the data, using that mathematical model and to formulate the subsequent decisions.

Both approaches (statistical technique and mathematical computation) usually require numerous operations which can only be implemented on a computer. Informatics is defined as the discipline that studies the information phenomenon, the systems of information, and the processing, transfer and utilization of informa® tion mainly with computer as the main tool. It is the science of systematic and rational processing, of information seens as the support of human activities. Reference 1 presented a comparation between informatics and mathematics, in what way it differs from physics, and how it is related to electrical engineering.

In reference 2 Dornyei distinguish theoretical informatics from applied informatics. Theoretical informatics is connected with the formal description of information system, and with the abstraction of the operations that can be carried out in the system. Applied informatics, on the other hand, deals with the methods and interrelations of the analysis, planning, and introduction of information system from the point of view of content, operation and organization. In terms of scope, he defined general informatics as all knowledge which refers to general and organizational question, while special informatics is the application of general informatics to particular fields.

THE STRUCTURE OF INFORMATICS

In the beginning was the universe, and the universe was with God, and the universe was the only system known to God. But when God creates man, and mankind flourishes, and the earth is full of systems, which are obviously created only by man to support mankind needs. As time goes on, one system merges with another to form a bigger system, and a bigger system fuses with other system to become a much bigger system. It is a healthy sign of vitality and at the same time an alarming sign of weakness. Now we come to a situation where there is only complexes of systems, growing or multiplying at a rate nobody knows quantitatively.

The multitude of systems existing today is only a reflection of the multitude of problems facing man and mankind. There are problems

whose solutions are beyond the scope of our present discussion. But there are problems which only informatics can serve better. It is the areas where computers truely find their just, proper and human use.

As an independent body of knowledge, informatics forms a four layer activities, concisely formulated as follows :

I : decision = intent structur + information
II : information = problem structure + program
III : program = data structure + algorithm
IV : algorithm = instruction structure + control

Treated as an entity, the first layers (I, II and sometime III) is appropriately called System Analysis, while layer II and III is commonly called system analysis (because in computer community it is the job of system analyst). Layer III and IV constitute the proper field of computer science, because in the data processing profession it is the job of the programmers and systems programmers (hardware engineers).

The logical consistency of the above statement should be noted. The intent structure suggests the existence of the problem structure. While the intent structure in its simplest form is only a list of intents collected at the problem recognation stage, it needs an advanced computer technique to transform it into a meaningful problem structure. This is particularly true for large scale systems, where the system boundary cannot be fully determined, and where norms or priority scales are to be planted into the system. The problem structure itself suggests the kinds of data to be collected, their relative importance, and the resolution level required to arrive at a really meaningful information. And finally the data structure suggests the instruction set needed by the computer to implement the processing effectively or the type of computer suitable for this particular operation.

In passing, it should be noted that control is essentially equivalent to decision. The structure is then closed loop. Decision can be considered as macro-instruction that operates on system at human (management) level, shile control is micro-instruction operating on *model* at computing level (because the model is only an abstraction of the system, as viewed by the system investigator). Hence the parallelism between the concept of data and information, and the concept of control dan decision should not be overlooked. The observability of the system is prerequisite to the controllability of the model, and subsequently the controllability of the model may impose some managability condition to the real system. The duality of computability and controllability is only a natural consequence of this consideration.

At this point the difference between informatics and computer science can be stressed. The objective of informatics is the development of effective systems (particularly information system) to support human activities. The objective of computer science is to develop a set of implementable operations to accomplish the conversion of data into information. In computer science the data structure is always viewed as intimately related to the storage structure and the electronic system functions of the computer. Thus it is also related to the algorithm needed to accomplish the conversion. Consequently the software aspect cannot be separated from the hardware aspect, and a curicullum that neglects or overlooks this fact is doomed to a failure, especially with the present advancement in microprocessor technology. Correspondingly, the computer science can become a sterile discipline if it is not developed within the discipline of informatics and system science in general. This justifies the creation of a laboratory or a program stydy in systems and informatics, organized within the department of electrical engineering.

A FRAMEWORK FOR CURRICULUM DEVELOPMENT

The structure as described above can be used as a basis for developing any system, involving computers. Within the scope of this seminar a brief remark is in order.

The structure lends itself to different emphasis in curriculum development. Institutions with strong tradition in hardware may focus mayor effort on layer IV, with minor attention to layer III. Good background in mathematics or strong orientation to applications is neccessary for a heavy emphasis on layer III and/or layer II. Institutions with mature experience in interdisciplinary activities is recommended to place more effort on layer I and II. In electrical engineering a balanced program covering the four layers can also be developed. This is highly recommended when the laboratory facility is not fully equipped, or when budget it the limiting factor for a sustained growth.

The structure can also be used as a guide for informatic development in developing countries.

Appropriately implemented, a spectrum of programs and services can be organized within the higher education system, to promote computer literacy and to prepare the nation on a secure course of electronic age. The budget can be efficiently allocated and the resources can be effectively directed to secure the realization of long range national objectives.

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KEMUNGKINAN MENAMBANG EMAS DENGAN SISTEM REBOISASI

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PENDAHULUAN

Emas, disebut pula sebagai logam Au merupakan salah satu jenis logam mulia yang mempunyai nilai tinggi. Boleh dikatakan dimana ada manusia yang "bermartabat" disitulah akan didapatkan emas yang sudah dipermuliakan. Peranan emas dalam ekonomi negara tidak diragukan lagi. Oleh sebab itu emas selalu dikejar orang dimanapun disimpan. Berita "Perampokan Besar Dekat Heathrow" (Kompas 28 November 1983), enam penjahat menggasak 6.800 batang emas bernilai Rp. 36 milyar dari sebuah gudang dekat Bandar Udara Heathrow London sebagai bukti nyata.

Emas dalam bentuk bahan galian di alam dijumpai dalam jumlah yang terbatas. Untuk mendapatkannyapun cukup sulit. Salah satu tambang emas yang masih berproduksi di pulau Jawa adalah Pertambangan Emas Cikotok dengan 3.752,30 hektar wilayah kuasa pertambangan eksplorasi dan 1.467 hektar wilayah pertambangan eksploitasi. Dari hasil penelitian tahun 1975 diperoleh angka bahwa bijih produksi berkadar 7,29 gram emas setiap ton, disamping didapatkan pula 191,490 gram perak setiap ton. Bijih tersebut terdapat dalam urat-urat mineral sulfida.

Proses alam selalu berjalan setiap saat. Daerah seluas itu cepat atau lambat akan mengalami proses pelapukan dan bijih yang mengandung emas akan terangkut tersebar di dalam lapisan tanah atas yang sulit untuk dipilih dan diambil.

PERMASALAHAN

Pencarian dan pemurnian logam mulia memerlukan investasi yang cukup tinggi. Pengambilan bijih yang mengandung logam emas dan perak serta logam hasil ikutan yang lain dilakukan pada urat-urat sulfida yang terkonsentrasi. Bantuan yang mengandung logam tersebut dalam proses penambangan cukup banyak yang tercecer. Alam dengan dibantu proses pelapukan, batuan yang ter-

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